RELIGHT s.r.l.

RECOVERY OF REEs FROM ELECTRICAL AND ELECTRONIC WASTE

Relight

- **1999:** Relight was born from a **cooperation project with Philips for the collection and recycling of fluorescent lamps** in whole italian territory

Treatment capacity: 40.000 ton/y

of dangerous waste

WEEE treated in 2015: 21.000 tons

Relight

Rho: Via Lainate 98/100

Treatment and recycling of electrical and electronic appliances

Authorized capacity: 40000 ton/y

Area: 11000 sm

- 6000 sm indoor
- 5000 sm outdoor

The activity

Collection and transport

Relight fleet: 8 trucks

Storage equipments

ELECTRICAL AND ELECTRONIC EQUIPMENT











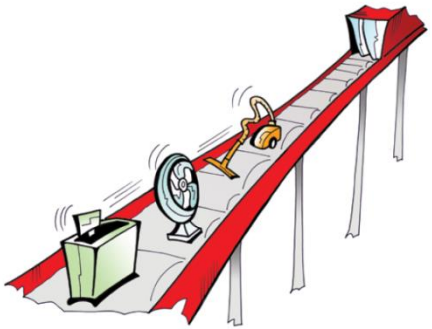




WEEE Recycling

WEEEs

Household Waste Recycling Centres



WEEE recycling in Europe

SWEDEN:
16,6 kg/pers./year

European target:
4 kg/pers./year

ITALY:
3,7 kg/pers./year

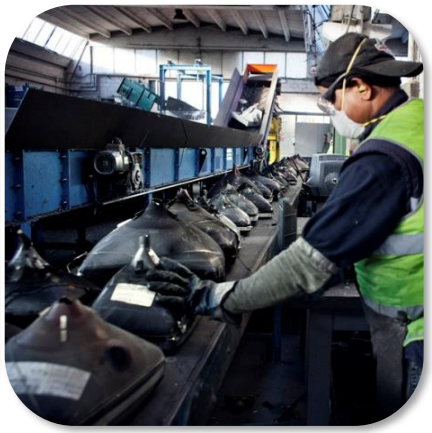
ROMANIA:
1,0 kg/pers./year

Relight's present collection area

Relight

Treatment and recovery of WEEE





Today: Relight has an integrated permit for :

- Automatic CRT treatment lines;
- Lamp sorting prototype;
- Lamp treatment plant;
- LCD desmantling
- Electronic appliances treatment plant;
- Hydrometallurgical plant for rare earths recovery

Lamps recycling process

Collection from municipalities and businesses

Lamps are sent to **recycling facility**

Lamp sorting

- Fluorescent lamps (compact, linear, circular)
- Halogen lamps
- Incandescent lamps

→ **Relight plant**

- LED lamps
- Sodium lamps

- HID lamps

→ **Third party recycling plant**

Mechanical dry treatment with Hg aspiration system

Lamps treatment

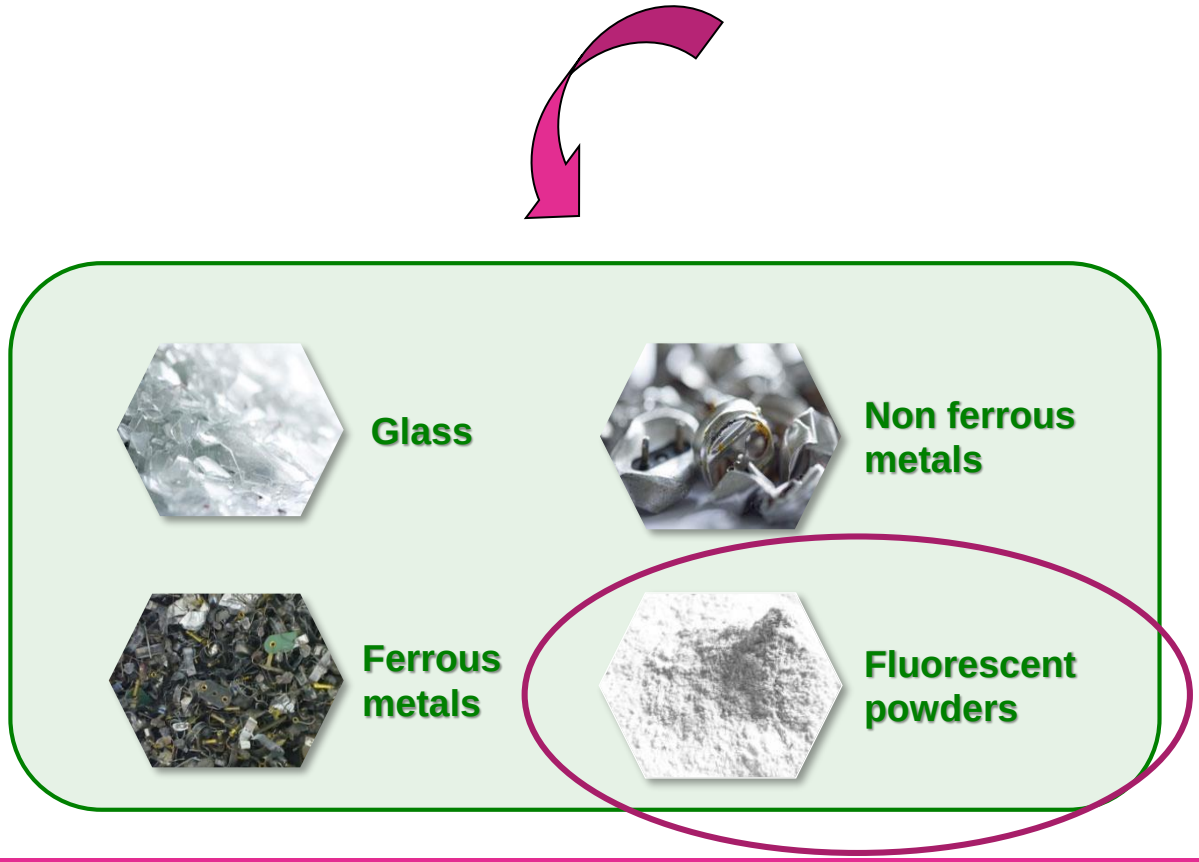
Fluorescent lamps treatment plant

- Works per batches of CFLs, LINEAR lamps.
- The process is performed in controlled atmosphere.
- Crush & sieve technology.

Lamps recycling process

Pre-processing of lamps

Through a dry, mechanical treatment lamps are crushed and the various fractions separated, using a combination of sieving, magnetic separation, non ferrous metals separation



The activity

Fluorescent lamps treatment and recycling plant

Glass

Relux tile

Closed loop: RELUX Tile made by recycled fluorescent tubes glass.

The activity

Fluorescent lamps treatment and recycling plant

Ferrous metals

Non ferrous metals

Recycled in metal smelters

LAMPS TOTAL RECOVERY RATE: 99%

Fluorescent powders

Bag filter

Cyclone

Carbon filter to prevent mercury dispersion in the air emissions.

Fluorescent powders

Sieving System

Rare Earths (%)	Powders
Yttrium	8,12
Europium	0,64
Gadolinium	0,46
Terbium	0,26
Cerium	0,61
Lanthanum	0,57

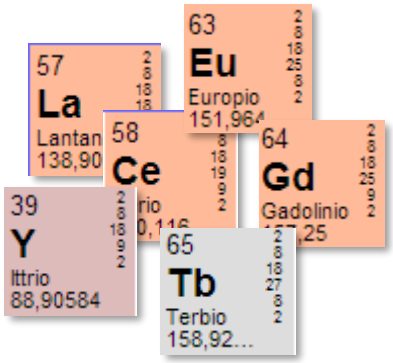
Fluorescent powders

Fluorescent powders ready for REE recovery

Analytical results show that:

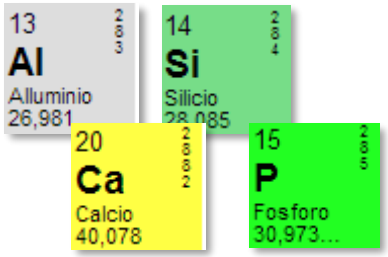
- there are significant concentrations of **Yttrium and Europium** (up to 10-15% in weight) in the powder
- low content of **glass** (less than 5 %)
- Low content of mercury (50-80 ppm)

Powders composition

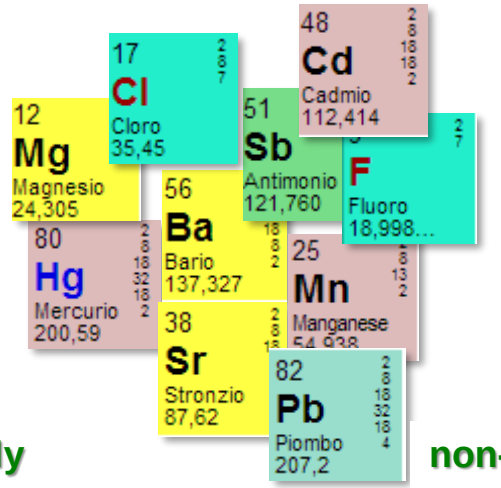


6 rare-earth elements

Complex chemical composition



non-REE elements in relatively large concentrations



non-REE elements in trace concentrations

CRT treatment lines

CRT treatment lines

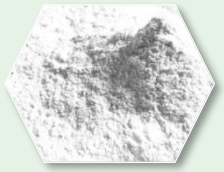
CRT TV/MONITORS cutting machine

Glass refining plant

Glass

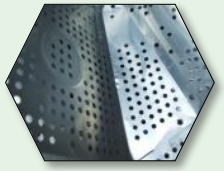
Yokes

Metals

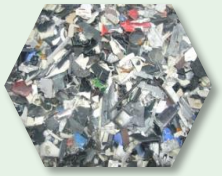


Fluorescent powder

Cables

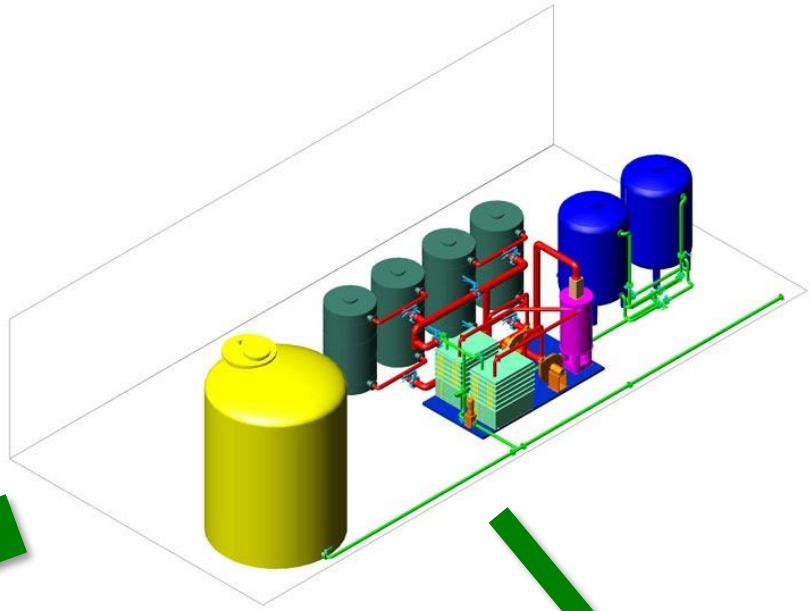


Non - ferrous metals



Plastic

Future of funnel glass



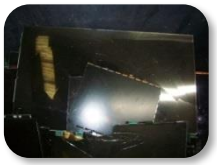
Lead

soluble and insoluble silicates

Relight: Activities

LCD Desmantling

LCD Panel



PCBs

PMMA

Cables

Fluorescent lamps

Plastic

SDA WEEE treatment

Motors

Metals

Plastic

PCBs

Environmental sustainability

ISO 14001 CERTIFICATION

EMAS III CERTIFICATION

The environmental management system has been integrated with complete security procedure in order to obtain also the OHSAS 18000 certification

Our mission??

On going research projects

From Ore to RECLAIM Sustainable Mining

Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste

hydroWEEE

Innovative Hydrometallurgical Processes to recover metals from WEEE including lamps and batteries

Remaghic

New Recovery Processes to produce Rare Earth - Magnesium Alloys of High Performance and Low Cost

illuminate

Automated Sorting and Recycling of Waste Lamps

HydroWEEE Projects

Phase 1) ‘’HydroWEEE ” project 2009/2012 (ended)

Innovative Hydrometallurgical Processes to recover metals from WEEE including lamps and batteries

Development of innovative process for the

recovery of rare and precious metals from WEEE

pilot plant in Relight

Phase 2) ‘’HydroWEEE DEMO” project 2012/2016 (ongoing)

European Commission

funded also DEMO phase

HydroWEEE - Partners

- **SMEs**
- **R&D Institutes**

ECO RECYCLING

Greentronics

RELIGHT

SET

SAPIENZA UNIVERSITÀ DI ROMA

UNIVERSITÀ POLITECNICA DELLE MARCHE

IMP WWW.INSTITUTEPUPIN.COM

SAIT

HydroWEEE – Phase 2: DEMO plants

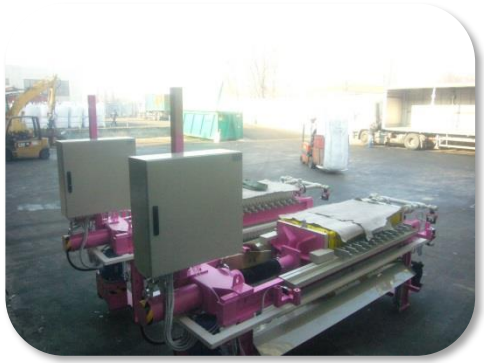
Innovative Hydrometallurgical Processes to recover metals from WEEE including lamps and batteries

The projects will give an impulse to **European competitiveness**, by applying **innovative processes for the recovery of important resources** for the economy and technological developments.

Phase 2: 2012 - 2016

GOAL

- 2 industrial, real-life **demonstration plants** (1 stationary in Relight's facility and 1 mobile) for the hydrometallurgical treatment of WEEE (CRTs, fluorescent lamps, PCBs, LCDs, lithium batteries, ...)
- Process sustainability assessment



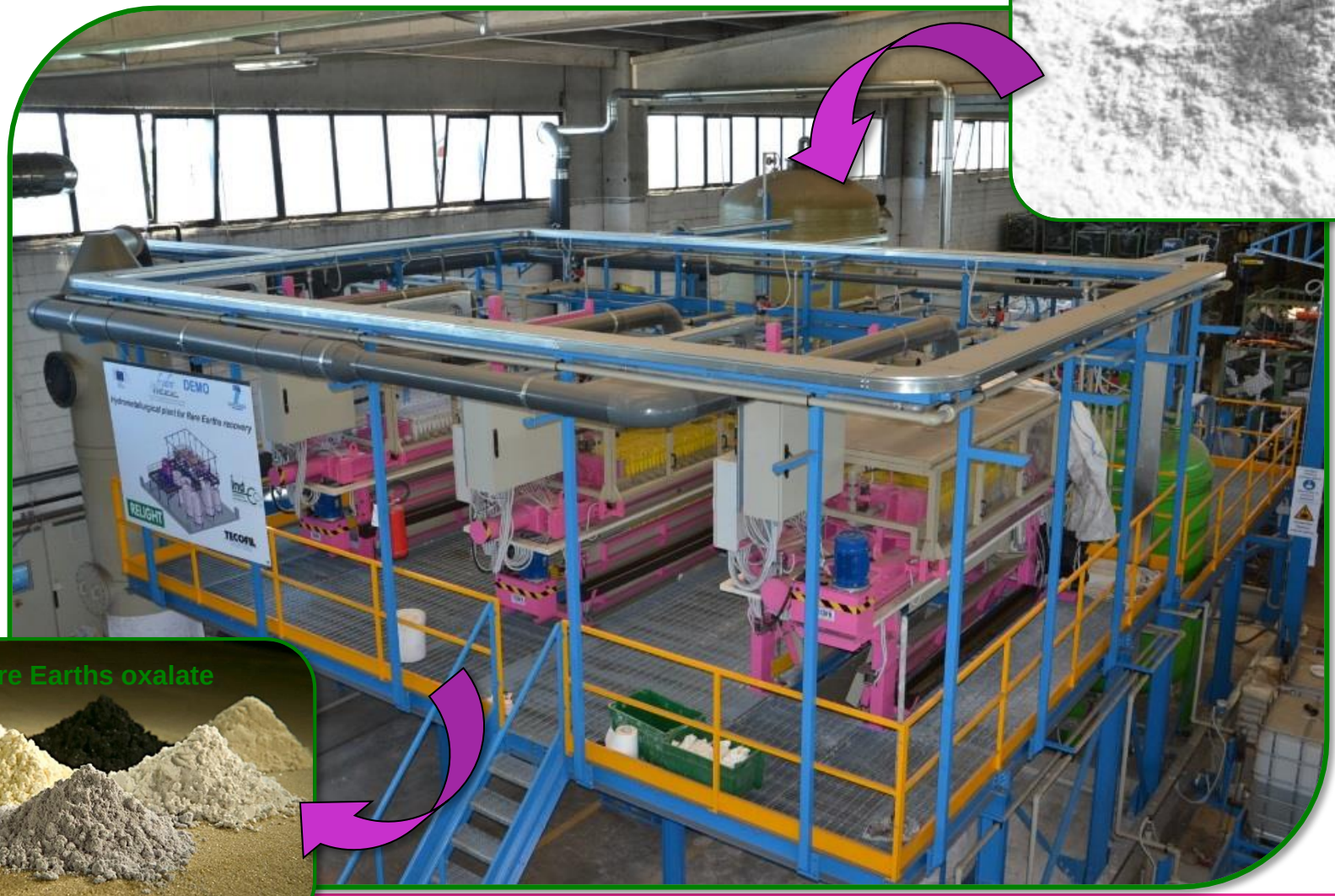

HydroWEEE – DEMO plant

Industrial plant for the recovery of Rare Earths from WEEEs

(during construction)

HydroWEEE DEMO – The plant today!

Industrial plant for the recovery of Rare Earths

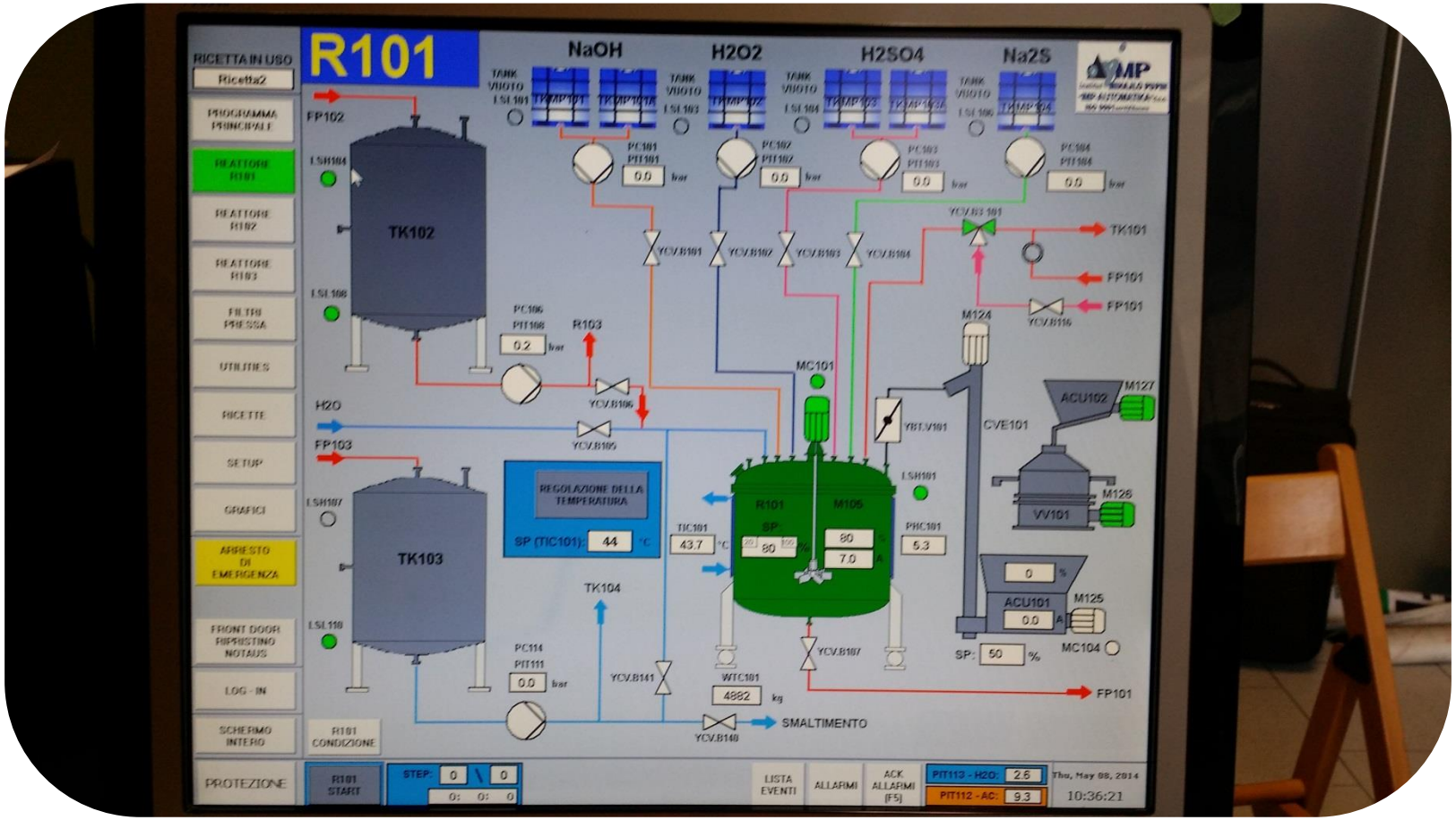


Fluorescent powders

Rare Earths oxalate

HydroWEEE - Demonstration phase

Dedicated and customized software for automation and control

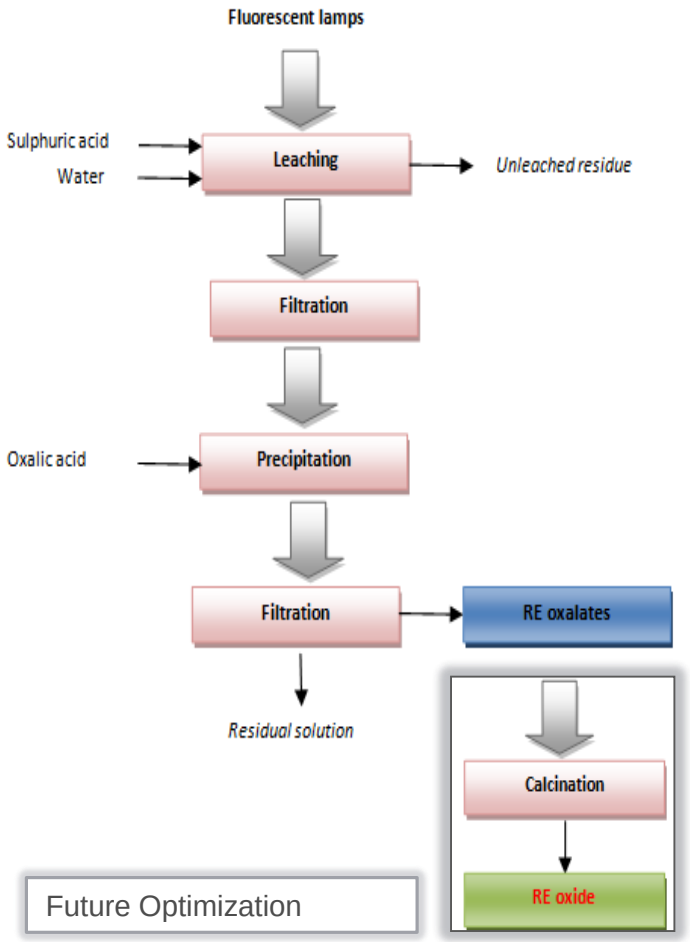


HydroWEEE DEMO – The Process

Hydrometallurgical process for

FLUORESCENT POWDERS

FROM LAMPS AND CRTS



Process includes the **treatment of residual solution with lime.**

The treated solution could be disposed or reused in the process.

HydroWEEE DEMO – The plant

Operational mode: BATCH

Capacity of the plant: ~ 400 t/year (3 batches/day for 220 days/year)

Recovery of RE oxalates: ~ 165 ton RARE EARTH OXALATE MIX/year

Content of RE in oxalates: ~ 97% (Y, Eu, Gd, Tb…)

Reuse of the water: 85%

HydroWEEE DEMO – RE market

HydroWEEEE technology is able to produce a semi-finished product, which concentrates Rare Earths in an oxalate form containing

~ 87% of Yttrium
~ 6 % of Europium
~ 3 % of Gadolinium
Terbium, Cerium, Lantanum

RE oxalate produced by HydroWEEE do not aim at competing with big Rare Earth suppliers, as it doesn't separate single elements.

It aims at recoverying and concentrating valuable and strategical material From WEEEs, easying further refiners' job and substituting primary materials in specific markets

RECLAIM project

Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste

This is the aim of the RECLAIM Project, where fluorescent lamps (FL), are one of the waste streams considered for their content of RECLAIM's key elements (Yttrium and Europium).

RECLAIM partners

- SMEs
- Multi-national industries
- R&D Institutes

TNO innovation for life

RELIGHT

OPTISORT
Visualizing Waste Values

INDUMETAL RECYCLING, S.A.

Coolrec

TECNICAS REUNIDAS

suez environnement
Ondeo IS

FAE

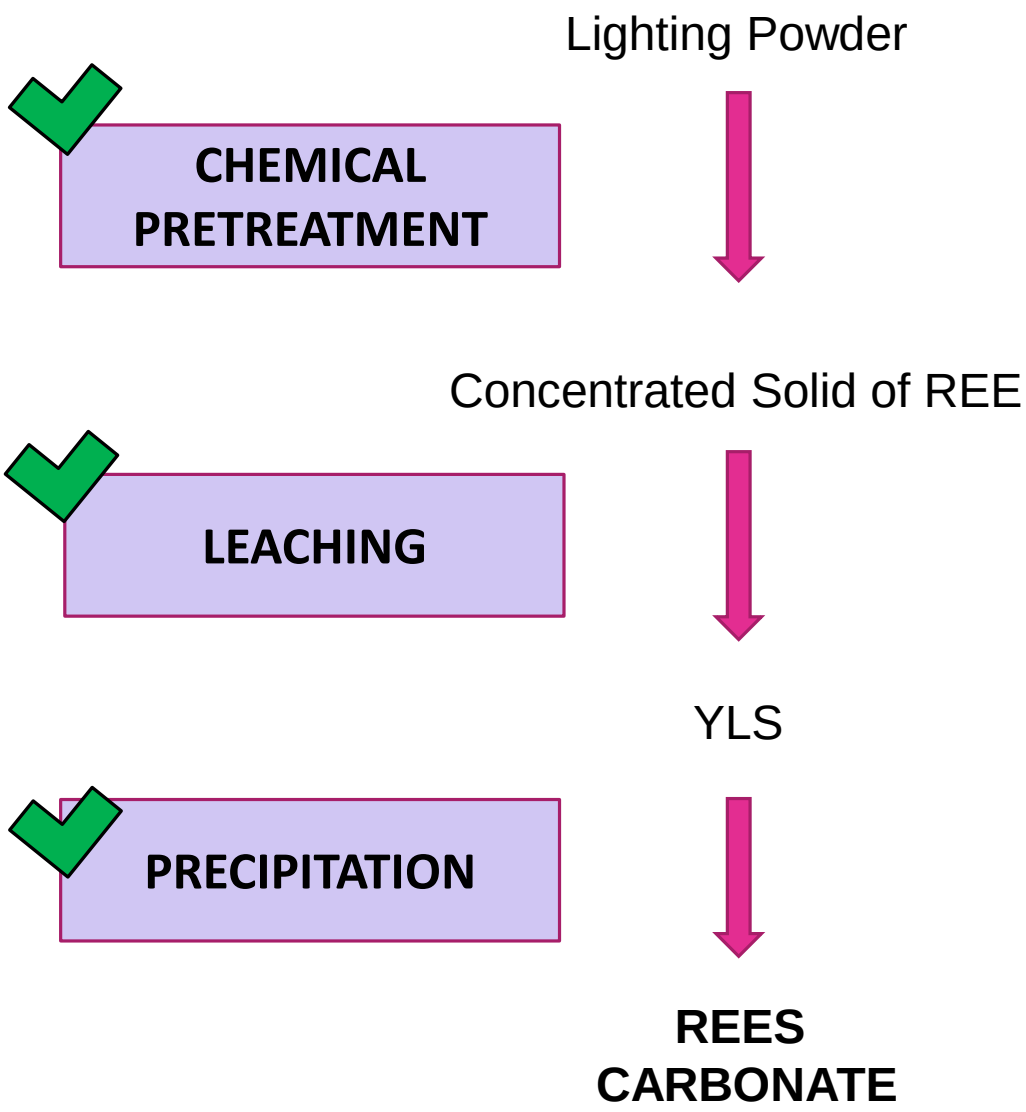
TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

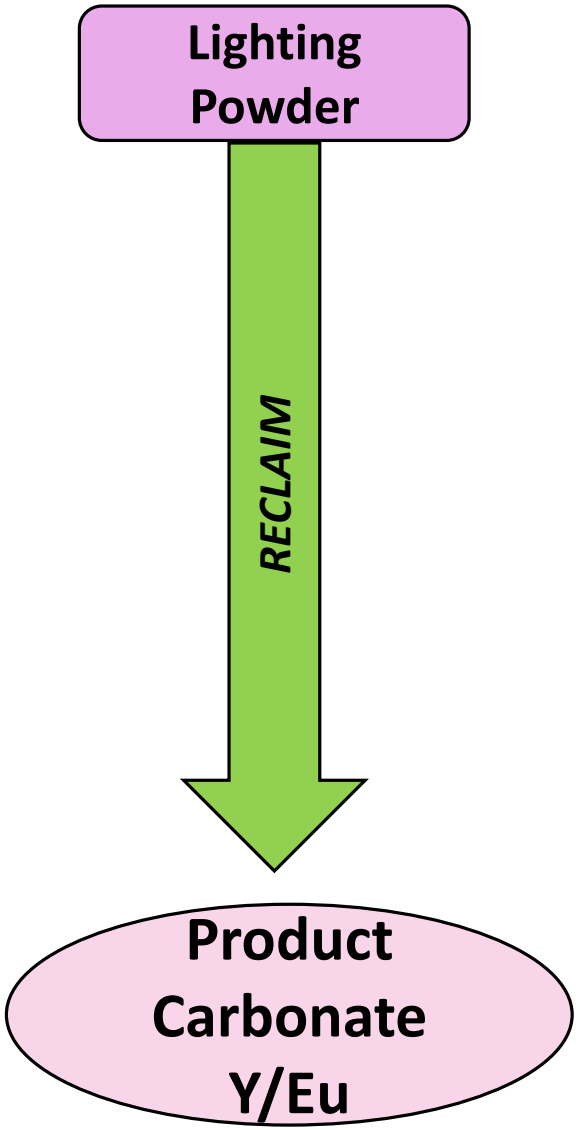
RECLAIM project

"**Urban mines**" and **REE recovery from waste phosphors in the End of Life Fluorescent Lamps** has attracted attention from researchers all over the world.

The REE concentration in the REE-containing components/devices of e-waste is **much higher** than in natural minerals ores.

RECLAIM process





RECLAIM pilot plant

RECLAIM product

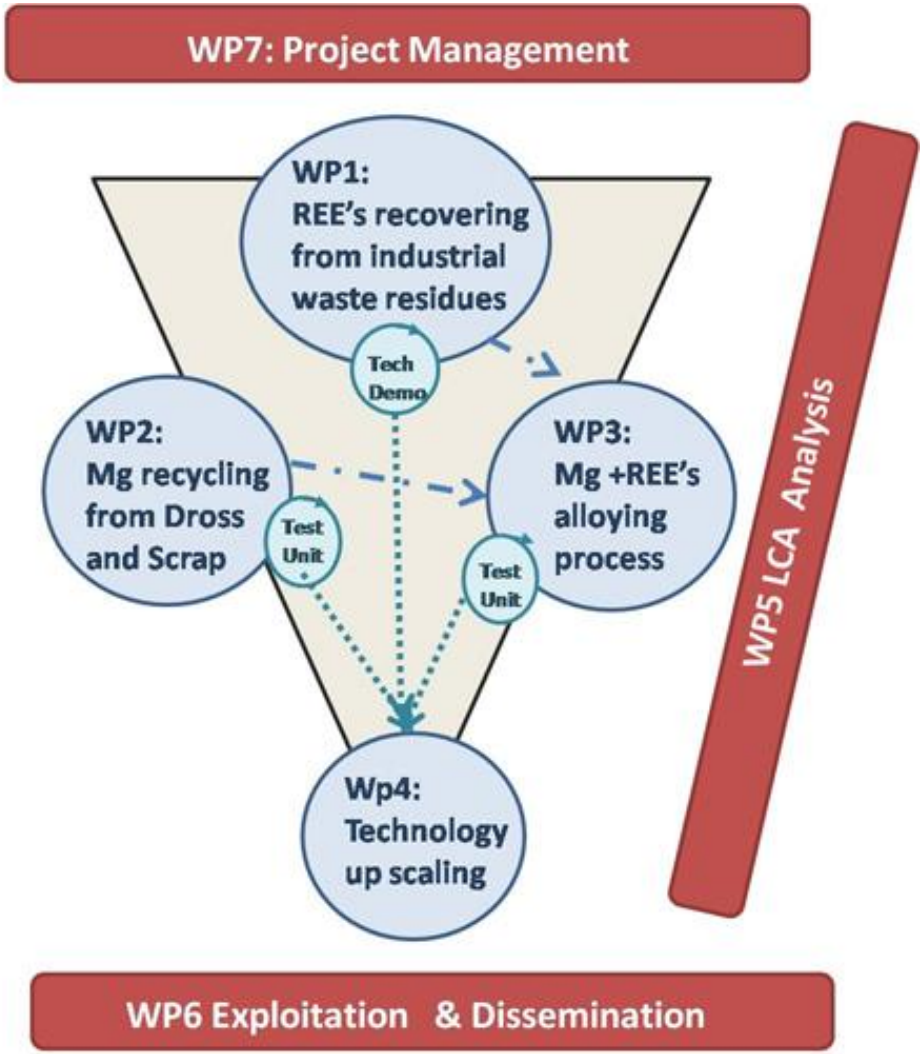
FINAL PRODUCT
Y/Eu CARBONATE

Remaghic

New Recovery Processes to produce Rare Earth -Magnesium Alloys of High Performance and Low Cost

REMAGHIC structure

The project builds its foundations on the research of recovery processes of those rare earths that will be later used to be alloyed with magnesium.



REMAGHIC Objectives

WP1 REE Recovery Processes from Industrial Waste Residues (Leader Relight)

Partners involved: Fraunhofer, TECNALIA, KUL, ITRB

The **Objectives** of this Work Package are:

- Evaluation of the main industrial waste residues containing REE
- Assessment of each of the RE elements to achieve a low cost raw material
- Optimization and Combination of the selected elements recovery strategies

THANK YOU

FOR YOUR ATTENTION!!!!!